

NYASALAND: Mt. Mlanje (*S. A. Neave*—type). S. RHODESIA: Sebakwe (*D. Dodds*). TRANSVAAL: Pretoria.

EXPLANATION OF PLATE I.

*Sphrigodes gunni*, Marshall,  $\times 9$ .  
*Deiradognathus fasciatus*, Marshall,  $\times 4$ .  
*Cylindrobatis ornata*, Marshall,  $\times 5$ .

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II.—*Bermudian Species of Donatia* (Tethya).

By BLANCHE BENJAMIN CROZIER.

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A SEARCH for budding sponges in the waters about Bermuda has revealed, in addition to members of other genera, three species of *Donatia*—*D. lyncurium*, *D. seychellensis*, and two varieties of *D. ingalli*. All, with the exception of *D. lyncurium*, which is comparatively rare, have been obtained in great abundance throughout their respective budding seasons, and kept under observation in their natural situations from September 1st to the end of May. These observations were made as a preliminary to a study, now in progress, of the germ cells of these sponges. I have enjoyed the use of certain equipment belonging to the Bermuda Biological Station, and from the Resident Naturalist of the Station, Dr. W. J. Crozier, I have constantly received assistance. To the Smithsonian Institution I am indebted for the loan of a collection of identified material.

I. *Donatia seychellensis* (E. P. Wright).

During the first week in September *Donatia seychellensis*, in moderate numbers, was found attached to the vegetation in Millbrook and Fairyland Creeks. These creeks are long narrow inlets bordered by mangroves. They are very shallow, and a large part of the bottom is covered with plants, flat-bladed "eel-grass" or turtle-grass, round-bladed grass, and algæ. The sponge attaches itself to the grass by rather slender anchoring filaments; in its most common position upon a round blade it sends out two principal filaments in opposite directions along the length of the blade, and from its base a few tiny hairs straight toward the blade. It may

also send out two or three filaments to neighbouring blades. Less commonly the attachment is to the flat-bladed grass or to algæ.

These sponges are of an orange colour, with no great variation from the lighter yellowish or greenish orange to the deeper reddish hue. The lighter colour is more common in small individuals, the deeper colour in large ones. Specimens preserved in alcohol are dull light brown. They are approximately spherical and from 8 to 20 mm. in diameter. The surface of a fresh specimen is divided up into polygonal denticulated areas deeper in colour and denser in texture than the intervening spaces, though not necessarily raised above them; and from the denticulations of these areas proceed strands, which form a close network in the spaces. In the lighter coloured specimens green shows through this network. The polygonal areas, or conules, occur all over the animal, though they vary greatly in shape even in any one specimen. They may be irregular polygons or nearly round; they may be flat or raised in the centre into a hillock with or without a spine projecting from its centre: at intervals the place of a conule is occupied by a smooth round swelling of the size of a bud but without a stalk; or the position may be occupied by a bud with a long or short stalk. A bud may come from only one conule or, less frequently, it may have two or three stalks from adjacent conules. The polygonal areas about the osculum are modified into long plates, but these do not stand up above the general surface, so that the osculum is not conspicuous unless open. It leads into a chamber into which a number of canals open. Its position bears no constant relation to the region of attachment of the sponge.

A typical full-grown bud is spherical or egg-shaped, 2 to 5 mm. in diameter, and of a bright clear orange colour. It is borne on a stalk varying in length from less than 1 mm. to several times the diameter of the bud. This stalk often continues through the bud and projects on the distal side as a slender spine or hair, usually with a small swelling at its end. From the sides of the bud grow numerous shorter spines, often with swellings at their free ends. If sponges bearing buds are kept in a jar with running water for a few days, the stalks elongate and finally the buds drop off and settle to the bottom, while the parent sponges send out numerous very long slender spines, which attach to the sides of the jar or to other individuals. In order to give some idea of the time required for bud formation, a specimen without buds was placed under observation in a jar of running water on Sept. 4. The polygonal areas at this time were not

raised above the general surface. On Sept. 5 they were projecting slightly. On Sept. 6 many of these elevations formed the ends of buds whose connexion with the parent sponge gradually narrowed to a slender stalk. Spines appeared from the sides and ends of the buds. On Sept. 7 the first bud dropped off.

If a fresh specimen of average size, *i. e.* about 15 mm. in diameter, be cut in two, it is seen to have a well-defined cortex 1.5 mm. thick, consisting of a thin tough inner layer of white fibrous material and a thick fleshy outer layer orange in colour. The choanosome is dark yellow at the centre and bright green at the periphery, the two colours merging into each other at two-thirds the distance from the centre to the periphery. Numerous large glistening white fibres run from the centre radially in all directions; in the cortex one of them spreads out at the base of each conule.

For the study of spicules preparations were made as follows:—From a freshly collected sponge a small piece was cut in any desired region, placed upon a microscope-slide, and covered with a few drops of KOH or NaOH solution; the slide was then held with forceps over a low alcohol flame at a sufficient distance so that the fluid would not quite boil but would become hot enough to soften the tissue. The alkali was then washed off with water from a pipette, and a cover-glass placed over the softened tissue and pressed down flat with a needle. This procedure was carried out with fragments taken at various points along the radius of a large number of specimens.

The sponge contains four kinds of spicules:—(1) *Megascleres*, typically stronglyloxeas, but with the eactine often rounded, 1.0 to 1.4 mm. long by 13 to 16  $\mu$  in diameter, with smaller forms down to 0.36 mm. by 6  $\mu$ . (2) *Spherasters*, ranging from 30 to 50  $\mu$  in diameter, with straight, abruptly pointed, oxeate actines, very abundant in the cortex, especially in its deeper portion, and at the periphery of the choanosome, but exceedingly rare elsewhere. (3) *Oxyasters*, 28 to 35  $\mu$  in diameter, with slender rays, usually six in number, straight and unbranched, though occasionally curved or bent and rarely branched. These are found occasionally in the outer half of the cortex and are fairly abundant in the inner half, while throughout the entire choanosome they are very numerous, by far the most abundant microsclere. (4) *Chiasters*—6.6 to 13.3  $\mu$  in diameter, and tylote—form a dense sheet at the periphery of the cortex, and are abundant through the remainder of the cortex and outer choanosome, but exceedingly rare in the deeper parts of the choanosome.

Several entire buds of various sizes, after having been treated as described above, have been examined and found to contain the same four classes of spicules which occur in the adult sponge. The structure of the various filaments sent out by this sponge was studied from teased living material. The anchoring filaments, bud-stalks, and fibres projecting from buds are composed of a core of megascleres surrounded by a dense layer of amœbocytes, among which are scattered numerous chiasmata. A few spherasters are found, especially in the little swellings at the ends of filaments.

*Donatia seychellensis*, first observed in Milbrook and Fairyland Creeks the first week in September, became more and more abundant, and the buds more numerous, until about the end of the month. By the middle of October there was a marked falling off in numbers, and those found were small and with few buds. During the winter only occasional specimens could be found. A recent collection, made on May 14, was a little more successful; it resulted in eight small specimens without buds.

Search has been made for *D. seychellensis*, as well as for other species here described, in most of the common shore collecting-grounds about Bermuda. In only one locality, besides the creeks mentioned above, has *D. seychellensis* been obtained, viz., on the shore of Agar's Island, where at low-tide level a few specimens have been found attached to stones. A careful search with a water-glass upon the reefs at Daniel's Head Flat failed to reveal any species of *Donatia*, as have also dredgings in Great Sound.

## II. *Donatia ingalli* (Bowerbank).

The two sponges here classified as varieties of *D. ingalli* do not correspond in all points with previous descriptions of that species; but in view of the fact that these descriptions have generally been based upon small numbers of preserved specimens, with no data as to the variations displayed by any one species in its natural habitat throughout the different phases of its reproductive cycle, it seems to me that nothing short of differences in the more fundamental points of internal anatomy warrants the recognition of separate species; and between *Donatia ingalli* as previously described and the Bermuda varieties there are no differences of this nature. On the other hand, in cases where both the animals in question are available in the living condition in unlimited numbers, superficial characters, if constant, are a sufficient reason for separating species; on these grounds there can be

no hesitation in recognizing these Bermuda varieties as specifically distinct from the Bermuda *Donatia seychellensis*, though they possess practically the same spiculation.

*Variety A.*—In the same habitat as has been described for *D. seychellensis* there was found, a little later in the season, an abundance of bright green spherical sponges slightly larger than *D. seychellensis*. On the 1st of September, when *D. seychellensis* was fairly numerous and even beginning to bud, only occasional specimens of the green form were obtained, and it was not until Sept. 18 that the first bud was seen. The surface of these sponges is raised into rounded hillocks, which are themselves composed of smaller rounded elevations. The cortex is much more fleshy and dense than that of *D. seychellensis*, and is solid, instead of showing a network of strands between the conules. The colour is uniform over the entire surface, with a slight variation among different individuals from dark bright green to a more nearly olive tint; in alcohol it is pink to light orange. There is a range of diameter from 11 to 32 mm., though specimens larger than 25 mm. are exceptional. The buds are clear bright green, and their form and arrangement are as in *D. seychellensis*. There are usually either one or two oscula, occasionally three or more, and in case of two or three they have a typical arrangement side by side 1 to 2 cm. apart. They are exceedingly conspicuous structures by reason of the modification of the conules about the oscula into long plates, which stand up around the opening and may project as much as 1 cm. beyond the general surface of the animal. A cross-section of this sponge shows the cortex to have twice the thickness of that of *D. seychellensis*; it consists of a thin, white, fibrous inner layer and a very thick, fleshy, green layer. The choanosome is dark yellow, and has at its centre a white fibrous core about 2.5 mm. in diameter, from which the radiating bundles proceed and spread out beneath the conules.

The spicules are in form and size similar to those of *D. seychellensis*, but differ somewhat from the latter in distribution and especially in the degree of branching of the oxyasters. (1) The *megasclores* are stronglyloxeas, with the eactine very frequently rounded, and range from 0.35 to 1.6 mm. in length and from 6.6 to 23  $\mu$  in diameter. (2) *Spherasters* similar to those of *D. seychellensis* are fairly frequent in all regions of the sponge and are exceedingly numerous in the cortex. (3) *Chiasters* are numerous throughout, and especially abundant in the cortex, at the



periphery of which they form a dense sheet; in addition to the usual tylote form there are some with oxcate actines. (4) The *oxyasters*, as contrasted with those of *D. seychellensis*, are commonly bent, evenly curved, or branched; they are very abundant throughout the choanosome, but relatively sparse in the cortex, especially its outer layer.

Though most abundant upon the eel-grass of tidal creeks, where it assumes a spherical form, *D. ingalli* variety A has a wider distribution in Bermuda waters than has *D. seychellensis*, and its form is modified to suit the various localities in which it occurs. Numerous specimens have been found attached to stones along the shore of Agar's Island at low-water mark, and these are usually flattened at the base to present a large area of attachment. In extreme cases the sponge is reduced to a hemisphere, or even grows over the edges of small stones, to irregularities in the surface of which it conforms. The anchoring filaments, which appear in *D. seychellensis* as slender fibres usually but two in number, are here heavy strands or even thick sheets, which grow out from the base of the sponge over its substratum. These sponges have been collected also from stones along the shores of Hungry Bay; while from the shore of Long Island and neighbouring islands have been obtained the largest specimens I have ever seen. They were attached by heavy anchoring strands to the vertical faces of rocks and at depths down to 2 fathoms, as contrasted with the very shallow positions in which all other specimens have appeared. This sponge has been much more frequent than *D. seychellensis* throughout the winter, but very sparse and lacking in buds as compared with its profusion and activity during the autumn months. In May it has been found in fair abundance, but with few buds, in the tidal creeks, not raised upon the eel-grass, but resting on the muddy bottom and upon dead shells.

*Variety B.*—Though the two varieties of *D. ingalli* are identical in most of their important anatomical characters, they are readily distinguished in their natural situations by their different external appearance; a few constant anatomical differences also permit one to distinguish between them after preservation. In the tidal creeks, on stones at low-water mark, and on the vertical faces of rocks at 2 fathoms depth, variety B occurs with variety A in about the proportion of 1 to 12. Its autumn budding-season coincides with that of variety A, and it is likewise fairly abundant upon the muddy bottoms of tidal creeks in early summer; but in this latter situation its degree of budding is noticeably greater than that

of variety A. It is prune-coloured, varying from purple to brown. In alcohol it is dull light brown with a pinkish cast. It shows less extremes of size than variety A, and has never been found with strongly developed anchoring filaments. The oscula, though of the same general character, are less pronounced, and in most cases their plates do not project conspicuously. The specimens which in the field are distinguished from variety A by these superficial characters, present upon study of their internal structure two points of difference from the more common green form:—(1) The cortex of variety A consists of a thin fibrous inner layer and a thick fleshy outer layer, while that of variety B, of equally conspicuous total thickness, is composed of a very thick fibrous inner cortex and a thin outer layer of fleshy material. Upon this point variety B agrees with the description given by Sollas of the cortex of *D. ingalli*, but both varieties have the great total cortex thickness mentioned by Dendy as characterizing the specimens of *D. ingalli* examined by him. (2) The cortex of variety B is densely packed with spherasters, a feature which agrees with the condition found by Dendy; while the cortical spherasters of variety A, though undoubtedly more numerous than in *D. seychellensis*, are far from being densely packed.

### III. *Donatia lynceurium* (auctorum).

*Donatia lynceurium* has apparently not passed through its season of greatest abundance and activity during the period covered by my observations. I have never found a single specimen in the eel-grass of the tidal creeks, and search in other localities has revealed only a few small animals without buds. These were attached to stones at low-water mark along the shore of Agar's Island. Their colour varies from light yellow to orange, the smaller ones being usually of the lighter hue. They range in diameter from 5 to 20 mm. None have been found attached to the stones by anchoring fibres, but the base is flattened, so that the centre of the radiating structures is not far above the region of attachment. The surface is covered with fine rounded elevations, which in a few of the larger specimens are modified into elongated plates about the osculum. A specimen of 20 mm. maximum diameter has a cortex 2 mm. thick, which consists of a very thin fibrous inner layer and a thick fleshy outer layer. The choanosome is dark yellow, fading into green at the periphery. There is a large fibrous core at the centre of the radiating bundles. The outer fleshy layer, yellow when the sponge is

alive, turns light pink in alcohol. There are three kinds of spicules:—(1) *Megascleres*, usually strongyloxeas, but with the oxeate ends often rounded. (2) *Spherasters*, 40 to 46  $\mu$  in diameter, with a large centrum and thick, unbranched, abruptly pointed actines, of which 6 to 8 are visible in one plane; they are numerous in the cortex and the outer choanosome, but rare elsewhere. (3) *Chiasters*—usually strongylote but sometimes faintly tylote, and with more than 6 rays—are very numerous throughout the entire sponge and densely packed in the outer half of the choanosome. They range in diameter from 10 to 16  $\mu$ , and are distinctly larger in the inner half of the choanosome than elsewhere.

Pembroke, Bermuda,  
May 25, 1917.

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### III.—*New Lepidoptera in the Joicey Collection.* By L. B. PROUT, F.E.S.

#### Family Lemoniidæ.

#### 1. *Sabalia barnsi*, sp. n.

♂.—74 mm.

Similar to *jacksoni*, E. M. Sharpe (Ann. & Mag. Nat. Hist. (6) v. p. 443, 1890), British East Africa, of which it may possibly be a subspecies. Abdomen beneath with the proximal segments more heavily blackened.

*Fore wing* slightly narrower; antemedian line (bar) thicker; no appreciable black dusting in the interspaces between  $R^3$  and  $M^1$ ; premarginal black band broader; proximal half of abdominal margin not blackened.